

CLAIMS

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1. In a radiotelephone operable in a code division multiple access
(CDMA) system, a method of acquiring a pilot signal, the method comprising:
storing samples of a received signal;
selecting a pseudo-random noise (PN) offset for a PN sequence;
correlating at least a portion of the samples with at least a portion of the
PN sequence to produce a correlation energy;
choosing a new PN offset;
comparing the correlation energy to an energy threshold; and
repeating the steps of correlating, choosing, and comparing until any of:
a PN sequence timing is found that produces the correlation energy
at least equal to the energy threshold, or
the step of comparing is performed a predetermined number of
times.

2. The method as in claim 1 wherein the step of choosing is responsive to
the step of correlating.

3. The method as in claim 2 further comprising:
generating, during the step of storing, the PN sequence; and
re-generating, during the step of correlating, the PN sequence with
reference to the PN offset.

4. The method as in claim 3 wherein the step of re-generating is
performed at a faster rate than the step of generating.

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5. The method as in claim 4 further comprising noting, during the step of
storing, a position of the PN sequence.

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1 6. The method as in claim 5 wherein the step of selecting is responsive to
2 the step of noting.

1 7. The method as in claim 5 wherein the new PN offset is chosen with
2 respect to the PN offset selected during the step of selecting.

1 8. The method as in claim 7 wherein the new PN offset represents an
2 incremented version of the PN offset selected during the step of selecting.

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1 9. A method of activating a radiotelephone operable in a code division
2 multiple access (CDMA) system, the method comprising the steps of:
3 activating at least a portion of a searcher receiver;
4 initiating the generation of a pseudo-random noise (PN) sequence;
5 storing samples of a received signal;
6 noting, during the step of storing, a position of the PN sequence;
7 producing, responsive to the step of noting, a reference position of the PN
8 sequence;
9 re-generating the PN sequence using the reference position;
10 correlating, during the step of re-generating, at least a portion of the
11 samples with at least a portion of the PN sequence to produce a
12 correlation energy;
13 incrementing, responsive to the step of re-generating, the reference
14 position;
15 comparing the correlation energy to an energy threshold; and
16 repeating the steps of re-generating, correlating, incrementing, and
17 comparing until any of:
18 a PN sequence timing is found that produces the correlation energy
19 at least equal to the energy threshold, or
20 the step of comparing is performed a predetermined number of
21 times.

1 10. The method as in claim 9 wherein the steps of storing, noting, and
2 producing occur at a first rate, and the steps of re-generating, correlating,
3 incrementing, and comparing occur at a second rate, the second rate faster than
4 the first rate.

1 11. The method as in claim 10 further comprising:
2 ranking each of the correlation energies as they are produced; and

3 storing a predetermined number of highest correlation energies and the
4 corresponding reference positions of the PN sequence.

1 12. The method as in claim 9 further comprising assigning, to at least one
2 demodulation branch of a receiver of the radiotelephone, a PN sequence timing
3 corresponding to the reference position that produces the correlation energy at
4 least equal to the energy threshold.

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1 13. In a code division multiple access (CDMA) radiotelephone, a method
2 of acquiring a pilot signal, the method comprising:
3 storing a predetermined number of samples of a received signal;
4 generating a pseudo-random noise (PN) sequence at each of a plurality of
5 different PN offsets;
6 correlating the predetermined number of samples with the PN sequence
7 at each of the plurality of different PN offsets to produce
8 corresponding correlation energies;
9 interrupting the correlating when a correlation energy at least equal to a
10 predetermined threshold is produced; and
11 choosing a PN sequence timing based upon the PN sequence and a PN
12 offset that produces a full correlation energy at least equal to the
13 predetermined threshold.

1 14. The method as in claim 13 wherein the step of choosing is responsive
2 to the step of interrupting.

1 15. The method as in claim 14 wherein the step of correlating comprises:
2 a first correlation involving a first portion of the samples and a first
3 portion of the PN sequence; and
4 a second correlation involving a second portion of the samples and a
5 second portion of the PN sequence,
6 wherein if during the step of correlating the first correlation produces an
7 intermediate correlation energy less than an intermediate threshold
8 for a particular PN offset, the second correlation at that particular
9 PN offset is not performed.

1 16. The method as in claim 14 wherein the step of correlating occurs at a
2 faster rate than the step of storing.

- 1 17. The method as in claim 16 further comprising assigning, responsive to
2 the step of choosing, the PN sequence timing to at least one demodulation
3 branch of a receiver of the radiotelephone.

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1 18. An apparatus for acquiring a pseudo-random (PN) sequence timing
2 for a code division multiple access (CDMA) radiotelephone, the apparatus
3 comprising:

4 a buffer to store samples of a received signal;
5 a correlator coupled to the buffer and operable to correlate at least a
6 portion of the samples with a PN sequence at each of a plurality of
7 different PN offsets to produce corresponding correlation energies;
8 and
9 a controller coupled to the correlator and operable to interrupt the
10 correlator when the PN sequence at a particular PN offset produces
11 a correlation energy at least equal to an energy threshold.

1 19. The apparatus as in claim 18 wherein the controller comprises any of a
2 microprocessor, a digital signal processor (DSP), and logic circuitry.

1 20. The apparatus as in claim 18 further comprising a memory coupled to
2 the correlator for storing a predetermined number of highest correlation energies
3 and corresponding PN offsets.

1 21. The apparatus as in claim 20 wherein if after a predetermined number
2 of correlations none of the produced correlation energies at least equal the
3 energy threshold, the controller chooses from the memory a PN offset
4 corresponding to a highest correlation energy.

1 22. The apparatus as in claim 18 further comprising a latch coupled to an
2 output of the correlator and operable, at each of the plurality of different PN
3 offsets, to latch an intermediate correlation result after correlation over a first
4 number of the samples and operable to latch a second correlation result after
5 correlation over a second number of the samples.

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1 23. The apparatus as in claim 18 further comprising a PN sequence
2 generator coupled to the buffer and the correlator to generate the PN sequence at
3 each of the plurality of different PN offsets.

1 24. The apparatus as in claim 23 wherein the PN sequence generator
2 comprises a first PN generator and a second PN generator, the first PN generator
3 operable to generate a PN sequence at a first rate to store the samples in the
4 buffer, the second PN generator operable to generate the PN sequence at each of
5 the plurality of different PN offsets at a second rate, the second rate faster than
6 the first rate.

1 25. A code division multiple access (CDMA) cellular telephone system
2 comprising:
3 at least one base station for transmitting a pilot signal having a particular
4 time alignment;
5 a cellular telephone operable to receive representations of the pilot signal,
6 the cellular telephone including:
7 a buffer to store samples of the representations of the pilot signal;
8 a correlator coupled to the buffer and operable to correlate at least
9 a portion of the samples with a pseudo-random noise (PN)
10 sequence at each of a plurality of different PN offsets to
11 produce corresponding correlation energies; and
12 a controller coupled to the correlator and operable to interrupt the
13 correlator when the PN sequence at a particular PN offset
14 produces a correlation energy at least equal to an energy
15 threshold.

1 26. The CDMA cellular telephone system as in claim 25 wherein the
2 controller comprises any of a microprocessor, a digital signal processor (DSP),
3 and logic circuitry.

1 27. The CDMA cellular telephone system as in claim 25 further
2 comprising a memory coupled to the correlator for storing a predetermined
3 number of highest correlation energies and corresponding PN offsets.

1 28. The CDMA cellular telephone system as in claim 27 wherein if after a
2 predetermined number of correlations none of the produced correlation energies
3 at least equal the energy threshold, the controller chooses from the memory a PN
4 offset corresponding to a highest correlation energy.

5 29. The CDMA cellular telephone system as in claim 25 further
6 comprising a latch coupled to an output of the correlator and operable, at each of
7 the plurality of different PN offsets, to latch an intermediate correlation result
8 after correlation over a first number of the samples and operable to latch a
9 second correlation result after correlation over a second number of the samples..

1 30. The CDMA cellular telephone system as in claim 25 further
2 comprising a PN sequence generator coupled to the buffer and the correlator to
3 generate the PN sequence at each of the plurality of different PN offsets.

1 31. The CDMA cellular telephone system as in claim 30 wherein the PN
2 sequence generator comprises a first PN generator and a second PN generator,
3 the first PN generator operable to generate a PN sequence at a first rate to store
4 the samples in the buffer, the second PN generator operable to generate the PN
5 sequence at each of the plurality of different PN offsets at a second rate, the
6 second rate faster than the first rate.

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1 32. A method of activating a code division multiple access (CDMA)
2 cellular telephone, the method comprising:
3 turning on the cellular telephone;
4 activating a searcher receiver;
5 receiving representations of a pilot signal;
6 generating a pseudo-random noise (PN) sequence;
7 storing, during the step of generating, digital samples of the
8 representations of the pilot signal;
9 re-generating the PN sequence at each of a plurality of PN offsets;
10 correlating the digital samples with the PN sequence at each of the
11 plurality of PN offsets to produce corresponding single correlation
12 energies;
13 storing a predetermined number of highest single correlation energies and
14 corresponding PN offsets;
15 comparing after each correlation each of the single correlation energies to
16 an energy threshold;
17 suspending the step of correlating responsive to finding a particular PN
18 offset producing a single correlation energy at least equal to the
19 energy threshold and using the particular PN offset as a PN
20 sequence timing of a demodulation branch in a receiver of the
21 cellular telephone; and
22 if, after the step of correlating is performed a predetermined number of
23 times without producing the single correlation energy at least equal
24 to the energy threshold, then choosing a PN offset corresponding to
25 a highest stored single correlation energy for the PN sequence
26 timing.

1 33. In a radiotelephone operable in a code division multiple access
2 (CDMA) system, a method of acquiring a pilot signal, the method comprising:
3 (a) generating a pseudo-random noise (PN) sequence at a first rate;
4 (b) storing samples of a received signal at the first rate;
5 (c) noting, during the step of storing, a reference position of the PN
6 sequence;
7 (d) storing the reference position;
8 (e) re-generating at a second rate the PN sequence starting from the
9 reference position, the second rate faster than the first rate;
10 (f) correlating, during the step or re-generating, at least a portion of the
11 samples with at least a portion of the PN sequence to produce a
12 correlation energy;
13 (g) selecting, responsive to the step of re-generating, a new reference
14 position;
15 (h) comparing the correlation energy to an energy threshold; and
16 (i) repeating steps (e) through (h) until any of:
17 a correlation results in the correlation energy at least equal to the
18 energy threshold, wherein a reference position
19 corresponding to the correlation energy at least equal to the
20 energy threshold is assigned to at least one demodulation
21 branch of a receiver of the radiotelephone, or
22 the step of comparing is performed a predetermined number of
23 times, wherein a reference position corresponding to a
24 highest correlation energy is assigned to the at least one
25 demodulation branch.

1 34. In a radiotelephone operable in a code division/multiple access
2 (CDMA) telephone system, a receiver circuit for acquiring a pseudo-random
3 noise (PN) sequence timing, the receiver circuit comprising:
4 a buffer to store samples of representations of at least one pilot signal;
5 a first PN generator coupled to the buffer to produce a PN sequence at
6 a first rate;
7 a second PN generator coupled to the buffer to produce the PN
8 sequence at a plurality of PN offsets at a second rate, the second
9 rate faster than the first rate;
10 a correlator coupled to the buffer and operable to correlate at least a
11 portion of the samples with the PN sequence at each of the
12 plurality of PN offsets to produce a correlation energy for each
13 correlation;
14 a comparator coupled to the correlator to compare each of the
15 correlation energies to an energy threshold; and
16 an energy post-processor coupled to the comparator and operable to
17 note a highest correlation energy;
18 wherein responsive to a particular PN offset resulting in a correlation
19 energy at least equal to an energy threshold, the correlator
20 suspends correlating and the particular PN offset is useful as a
21 PN sequence timing, and
22 wherein responsive to the correlator performing a predetermined
23 number of correlations and none of the plurality of PN offsets
24 results in the correlation energy at least equal to the energy
25 threshold, a PN offset corresponding to the highest correlation
26 energy is selected as the PN sequence timing.